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# THE MANUFACTURING OPERATIONS EDGE: THE MES PERFORMANCE KICK

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**ABERDEEN**



This report explores how Best-in-Class organizations deploy manufacturing execution systems, and the performance boost they receive for doing so. As we enter the era of cloud and industrial IoT, Best-in-Class organizations are better positioned to reap the benefits of MOM/MES systems, including improved operational efficiency, faster decision making, improved tracking and traceability, improved visibility into the factory, and better quality.

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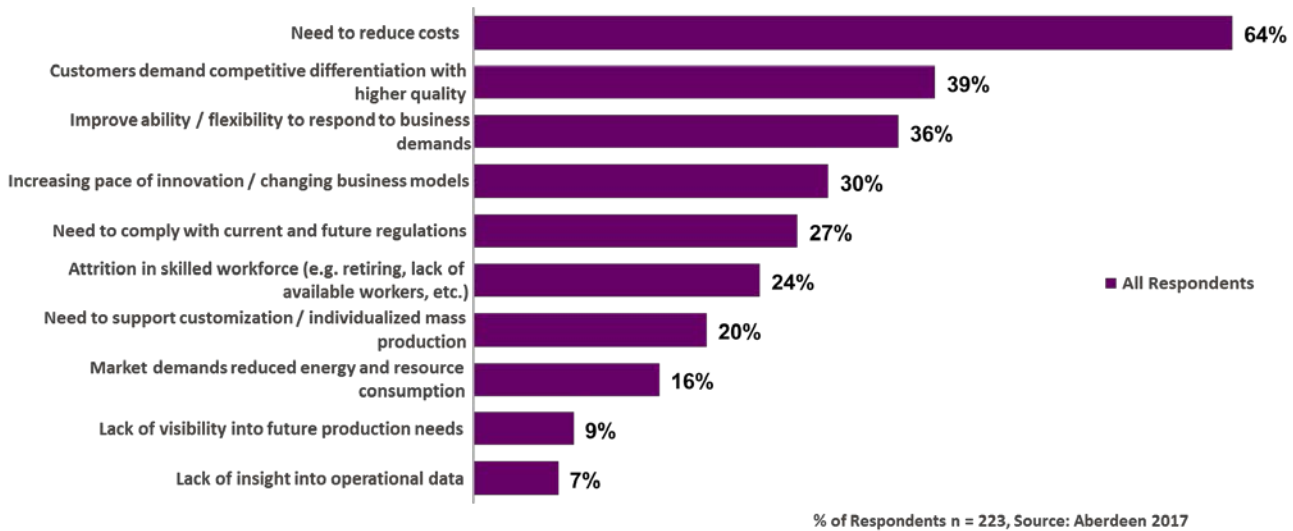
### **Pressures and Challenges Drive MOM/MES Usage**

Manufacturing today faces a number of pressures and challenges. These include rising costs, operational inefficiencies, and shortened product release cycles. To meet these challenges and improve manufacturing operations, manufacturers are turning to manufacturing operations management (MOM) and manufacturing execution systems (MES). As Industry 4.0 ushers in the Internet of Things (IoT), the cloud, and big data analytics, MOM/MES leverages this new influx of data, makes sense of it, and drives value across production, quality, and compliance. MOM/MES provides end-to-end, real-time process visibility and traceability, along with the ability to manage, monitor, synchronize, and optimize physical production processes.

**Manufacturing operations management (MOM)** is a methodology for viewing an end-to-end manufacturing processes with a view to optimizing efficiency. There are many types of MOM software, including production management, performance analysis, quality and compliance, and human machine interface (HMI).

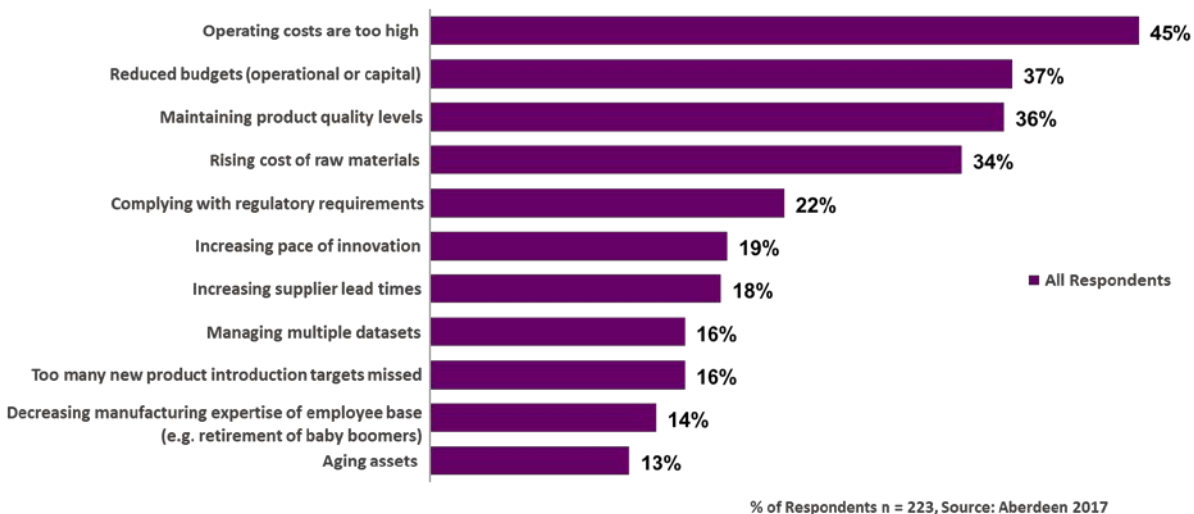
**Manufacturing execution systems (MES)** manage, monitor and synchronize the execution of real-time, physical processes involved in transforming raw materials into intermediate and/or finished goods. They coordinate this execution of work orders with production scheduling and enterprise-level systems. MES applications also provide feedback on process performance, and support component- and material-level traceability, genealogy, and integration with process history, where required.

Figure 1: Top Pressures on Manufacturing Operations



Our MOM/MES and Manufacturing Operations Benchmark Study illustrates the need for better operational efficiency — it stands out as a major pressure for all companies. Forty-five percent of respondents say that operating costs are too high, with 64% citing the pressure of needing to reduce costs. Thirty-seven percent are challenged by reduced budgets (operational or capital), and 36% by managing product quality levels. The need to comply with current and future regulations is a pressure felt by 27% of respondents.

Figure 2: Top Challenges in Managing Manufacturing Operations



Overall, 55% of survey respondents say that too many operational inefficiencies (e.g., waste, delays, false starts, rework) are a huge challenge for their organization. Additionally, manufacturers are pressed by expectations for real-time, critical decision-making across operations (aka a shorter decision window).

The demands on manufacturers are significant. And Best-in-Class organizations are responding to these pressures and meeting these challenges by pursuing operational excellence through MES, focusing on tracking and traceability, visibility, and quality. In short, they are seizing on the MES advantage and reaping the benefits.

### Defining the Best-in-Class

To identify best practices in MOM/MES for manufacturers, Aberdeen used three key performance indicators (KPIs) to distinguish the Best-in-Class from Industry Average and Laggard organizations. These are:

- ▶ **Complete and On-Time Delivery.** Percentage of complete products delivered on-time as compared to total commitment.
- ▶ **Overall Equipment Effectiveness (OEE).** Measured in percent as: Availability x Performance x Quality.
- ▶ **Manufacturing Cycle Time.** Measured in percent improvement over the past two years.

Respondents were divided among three categories based on their aggregate performances in these three metrics: the top 20% of performers (Best-in-Class), the middle 50% (Industry Average), and the bottom 30% of performers (Laggards). Table 1 summarizes the aggregate performance of Best-in-Class, Industry Average, and Laggard organizations.

The Aberdeen maturity class framework identifies three groups of survey respondents. The data determines overall company performance, based on self-reported performance across several key metrics. Each respondent falls into one of three categories:

- ▶ **Best-in-Class:** Top 20% of respondents based on performance
- ▶ **Industry Average:** Middle 50% of respondents based on performance
- ▶ **Laggard:** Bottom 30% of respondents based on performance

Sometimes we use a fourth category, All Others. This is a combination of Industry Average and Laggard.

Table 1: Top Performers Earn Best-in-Class Status

Definition of Maturity Class	Mean Class Performance
<b>Best-in-Class:</b> Top 20% of aggregate performance scorers	98% Complete and On-Time Shipments 98% Overall Equipment Effectiveness (OEE) 25% Improvement in Manufacturing Cycle Time (2 Years)
<b>Industry Average:</b> Middle 50% of aggregate performance scorers	92% Complete and On-Time Shipments 91% Overall Equipment Effectiveness (OEE) 8% Improvement in Manufacturing Cycle Time (2 Years)
<b>Laggard:</b> Bottom 30% of aggregate performance scorers	77% Complete and On-Time Shipments 74% Overall Equipment Effectiveness (OEE) 0% Improvement in Manufacturing Cycle Time (2 Years)

Source: Aberdeen Group, September 2017

Best-in-Class manufacturers realize higher performance results both in customer metric—by delivering 98% of products promised on time—and internal plant metrics—by effectively utilizing assets (98% OEE) and achieving at 25% improvement in manufacturing cycle time over the past two years. Clearly, the Best-in-Class are enjoying significantly lower manufacturing costs coupled with better customer services. The key to this benchmark report is to determine just how the Best-in-Class are achieving these results.



## Best-in-Class Pursue Better Path to Operational Excellence

Best-in-Class companies are pursuing a better strategic path than All Others and have achieved superior results for their efforts (Table 2).

Table 2: Best-in-Class Firms Achieve Superior Results

Best-in-Class Key Performance Indicator	Best-in-Class	All Others	Best-in-Class Performance Edge
Complete and On-time Delivery	98%	87%	13% better
Overall Equipment Effectiveness (OEE)	99%	85%	16% better
Capacity Utilization	97%	83%	17% better
Raw Material Utilization	96%	83%	16% better
Manufacturing Cycle Time Improvement over 2 Years	25%	5%	5 Times better
Operating Margins Improvement over 2 Years	25%	5%	5 Times better
Time to Decision Improvement over 2 Years	25%	5%	5 Times better

n=223, September 2017

How do the Best-in-Class achieve these superior results? Here is Aberdeen's analysis of Best-in-Class operational excellence, especially as it relates to MES:

1. **Tracking and Traceability.** The Best-in-Class are 50% more likely than All Others to build compliance and traceability into production processes. Being able to track every relevant part, process, and final product means manufacturers quickly isolate defects, stop adding value to defective work in process, and limit the need for costly rework through product recalls. Twenty-nine percent of the Best-in-Class deploy or plan to deploy track and trace via Industrial IoT technology.

In addition, the Best-in-Class contribute to trackability with digital twins (see sidebar). Best-in-Class firms are 1.8 times more likely than All Others to deploy the digital twin in designing products and in their manufacturing processes. In product production, the Best-in-Class edge jumps to 2.6 times more deployment of the digital twin than All Others. In this era of IoT, as MES providers fully extend the digital twin to manufacturing execution, MES's position as a bedrock system becomes even stronger.

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### Definition: Digital Twin

**A virtual representation of a product, process, physical asset, or service as an integrated system of data, models and analysis tools maintained over the entire lifecycle.**

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2. **Visibility.** For 74% of the Best-in-Class, it begins with real-time visibility into the status of all processes and manufacturing data. Visibility continues with centralized manufacturing data, with 71% of the Best-in-Class locating their manufacturing data in a centralized repository — 1.6 times greater than All Others. Further, visibility also means [real-time operational dashboards](#) increasingly based on IoT technology. Fifty-three percent of the Best-in-Class say that plant data is handled in real-time/event-driven dashboards with role-based data accessibility, navigation, aggregation, or drill-down — 1.7 times greater than All Others.
3. **Quality.** Seventy-one percent of the Best-in-Class cite quality as a central concern. This maturity class values quality and compliance at a rate 1.8 times higher than All Others. Industrial IoT also greatly enhances manufacturing quality. If a quality issue arises on the shop floor, the cyber-physical system (see sidebar) springs into action using real-time notification to business systems via IoT sensor networks. This can trigger necessary corrective actions for real-time events and scheduled tasks, including dynamic adjustment of product runs. Manufacturers are extending asset quality even further by eliminating machine downtime using predictive maintenance. Sixty percent of Best-in-Class have the ability to schedule predictive maintenance of assets; this is 43% better than All Others. Lastly, the Best-in-Class bolster quality through elimination of defective raw material and scrap, performing 16% better in raw material utilization than All Others.

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**Definition: cyber-physical system**

**Comprises physical components that can be monitored, controlled, and optimized by smart sensors software, and actuators.**

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### The MES Performance Edge

MES plays a foundational role in the success of manufacturing leaders in achieving tracking and traceability, visibility, and quality. Best-in-Class firms are 50% more likely to implement MES than All Others and 76% more likely to implement MOM. Moreover, organizations deploying manufacturing execution systems, receive a pronounced performance boost from such deployment.

Table 3 quantifies the MES Edge across production, product, and business metrics. For example, comparing the Best-in-Class manufacturing cycle time improvement in Table 2 (5x) to MES user manufacturing time improvement in Table 3 (2x), implies that MES is responsible for 40% of the total Best-in-Class edge, and that makes MES very important indeed!

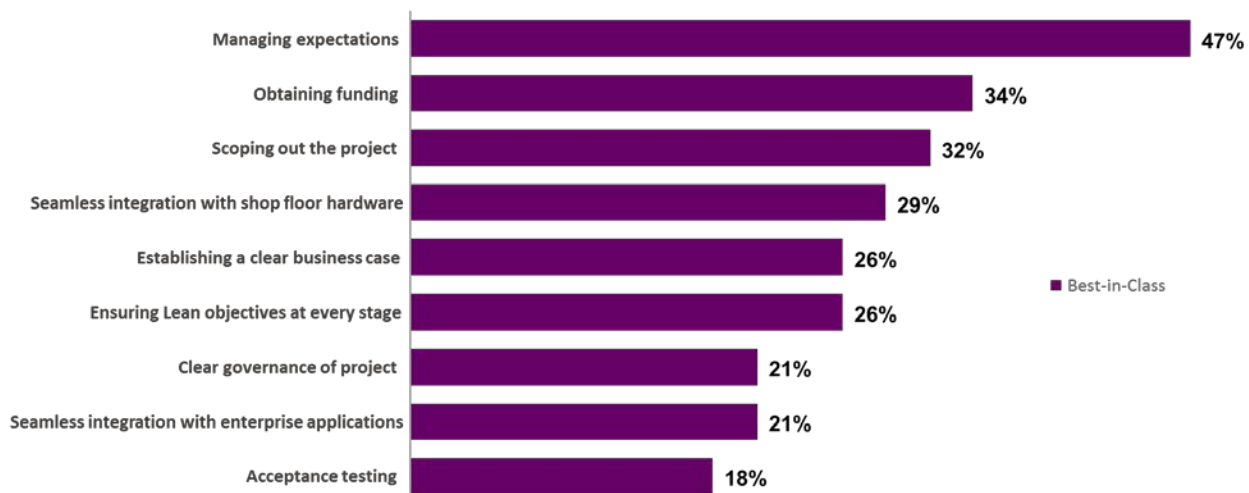
Table 3: The MES Performance Kick

	Key Performance Indicator	MES Implemented	MES not Implemented	The MES Edge
Production	Complete and on-time shipments	92%	87%	6% better
	Overall Equipment Effectiveness	90%	85%	6% better
	Capacity Utilization	90%	84%	7% better
	Raw material utilization	89%	85%	5% better
Product (% of products)	Product launch dates met	73%	68%	6% better
	Product cost targets met	70%	67%	4% better
	Quality targets at design release met	75%	67%	12% better
	Product revenue targets met	70%	65%	8% better
Business (over past 2 years)	Time to decision improvement	14%	6%	2.3 times better
	Operating margin improvement	13%	6%	2.2 times better
	Total cost per unit improvement	12%	6%	2 times better
	Manufacturing cycle time improvement	14%	7%	2 times better

n=223, September 2017

It's no mean feat to achieve such results: MES users have overcome many management and technical challenges to eke out these hard-won gains (Figure 3).

Figure 3: Best-In-Class MES Implementation Hurdles



% of Respondents n = 223, Source: Aberdeen 2017

On the management side of the house, Best-in-Class organizations have painstakingly focused on managing expectations (47%). Also, to obtain MES project funding, the Best-in-Class have concentrated on establishing

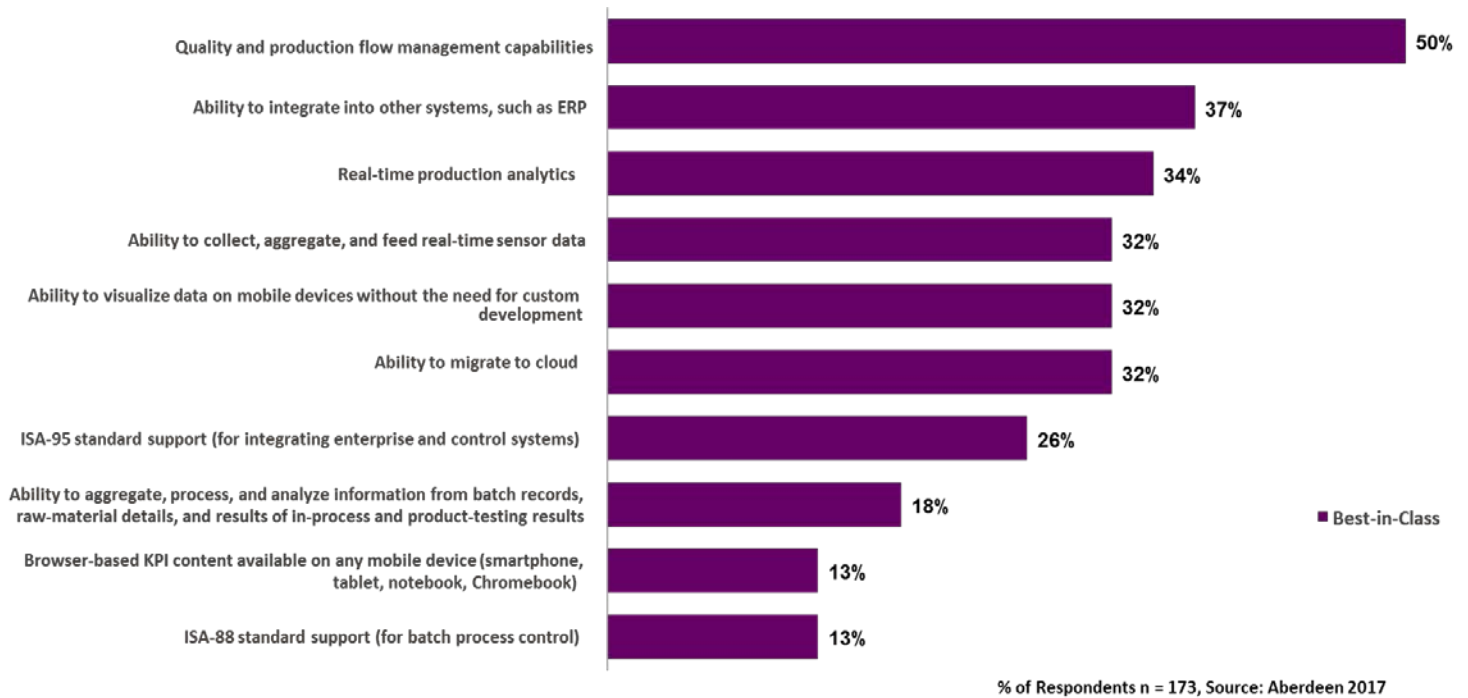


a clear business case, determining clear governance, and establishing proper project scope.

Once organizations have jumped through all the management hoops, technical issues predominate. The MES system must feature seamless integration with both shop floor hardware and enterprise applications, while ensuring lean objectives at every stage. Only then can Best-in-Class organizations pass acceptance testing and deploy their MES system in a production environment.

And what do Best-in-Class organizations seek from their MES? The capabilities most highly prized relate to quality, production flow management, integration into enterprise applications such as ERP, real-time production analytics, out-of-the box data visualization on mobile devices, and ability to migrate to the cloud (Figure 4).

Figure 4: Best-In-Class MES Capabilities



## The Industry 4.0 Journey Ahead: Cloud and Industrial IoT

Despite their considerable success in achieving operational excellence through MES, the Best-in-Class are not finished. They have begun their journey to [Industry 4.0](#), and MES is a key part of that journey, especially as it relates to the cloud and industrial IoT.

Best-in-Class firms are 23% more likely to look for cloud migration capabilities in a MOM/MES solution. They seek cloud benefits like lower costs or pay-as-you-go subscription pricing, scalability, faster implementation speed or automatic updates, easier deployment, real-time visibility, and efficiency in total lifecycle costs.


As plant managers reach a greater level of comfort with the cloud, movement toward cloud-based MES is no longer beyond the realm of imagination, and it is no longer heresy to consider moving MES or certain MES components to the cloud. When asked to describe their MOM/MES software delivery model, over half (53%) still choose the traditional on-premise software delivery model. The Futuristic Fifth (21%) favor a pure cloud-based software delivery. However, the hybrid cloud may be the sweet spot for MES, as reflected in the spirit of experimentation represented in the 23% of respondents choosing some combination of on-premise and cloud.

Likewise, as Best-in-Class managers move towards IoT-connected equipment in the plant, MES turns out to be more important than ever as the unifying force to bring together all production information in real time. In addition to better uptime, quality, and safety, managers look to IoT to reduce costs; improve visibility, agility, and responsiveness; and to increase operations speed. These IoT expectations dovetail very well with the goals of manufacturing execution systems.

### Summary

Best-in-Class organizations deploy MES and receive a performance boost for doing so. As we enter the era of cloud and industrial IoT, the Best-in-Class are better positioned than All Others to reap the benefits of MOM/MES — including improved operational efficiency, faster decision making, improved tracking and traceability, improved visibility into the factory, and better quality.

The pressures and challenges driving manufacturers to use manufacturing execution systems include cost reduction in manufacturing, the need to driving revenue growth, and faster time-to



market. To meet these, the Best-in-Class are developing MES capabilities for better quality, production flow management, enterprise application integration, real-time production analytics, and data visualization on mobile devices. Implementing these capabilities yields increased operations speed; higher asset uptime and efficiency; improved visibility, agility and responsiveness; and improved safety.

Best-in-Class companies are pursuing a better strategic path to operational excellence, and have achieved superior results for their efforts. This maturity class implements manufacturing execution systems and manufacturing operations management at very high rates, achieving operational excellence through tracking and traceability, visibility, and quality.

MES plays a foundational role in the success of manufacturing. Users have overcome many management and technical challenges to achieve and maintain their hard-won gains. Despite their considerable success in achieving operational excellence through MES, the Best-in-Class are not finished. They have only begun their journey to Industry 4.0. As part of that journey, key enablers for future MES scalability and real-time visibility are cloud capabilities and the Internet of Things.

## Related Research

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[\*A Consolidated Approach to Manufacturing Operations Management \(MOM\); June 2016\*](#)

[\*Reduce the Friction in Manufacturing Operations Planning With ERP and MES; June 2015\*](#)

[\*Manufacturing Operations Management \(MOM\): A Guide to Business Process in the Factory; July 2015\*](#)

[\*Use Real-time Product Traceability to Eliminate Waste and Delight Customers, August 2017\*](#)



## About Aberdeen Group

Since 1988, Aberdeen Group has published research that helps businesses worldwide to improve their performance. Our analysts derive fact-based, vendor-neutral insights from a proprietary analytical framework, which identifies Best-in-Class organizations from primary research conducted with industry practitioners. The resulting research content is used by hundreds of thousands of business professionals to drive smarter decision-making and improve business strategies. Aberdeen Group is headquartered in Waltham, Massachusetts, USA.

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